Ghost shrimps (Crustacea, Decapoda, Axiidea) of the Persian Gulf explorer Cruise collection

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Abstract

Ghost shrimps are common burrowing decapods in littoral and sublittoral marine environments. The Persian Gulf explorer Cruise was carried out in the Persian Gulf and the Gulf of Oman in April-May 2019. The sampling of macrobenthos assemblages was done by box corer from soft substrate. The following five species belonging to four families were identified: *Aquaballianassa ehsani* (Sepahvand, Tudge & Momtazi, 2018) and *Caviallianassa* sp. (Callianassidae); *Michaelcallianassa persica* Sepahvand, Momtazi & Tudge, 2020 (Callichiridae); *Andamancalliax* sp. (Eucalliacidae); and *Gourretia qeshmensis* Sepahvand, Rastegar-Pouyani and Momtazi, 2016 (Ctenochelidae). With these new records, 28 species of these borrowing shrimps are known in the Persian Gulf and the Gulf of Oman.

Keywords: Persian Gulf explore Cruise, ghost shrimp, Macroinvertebrates, biodiversity.

Introduction

Infraorder Axiidea are common burrowing decapods in littoral and sublittoral marine environments. Axiidean and gebiideans mostly, was known as obligatory burrowing shrimps except in larval stage (Hernáez 2018, 2021). They are widely distributed especially in sand and mud flats and shallow subtidal areas around the world (Dworschak, 2005). Different suitable habitats for burrowing organisms, especially mud shrimps, such as sandy-mud, muddy, sandy, rocky and muddy-sand dominated by mollusk shells and fragments (Sepahvand et al., 2013) could be found in the Persian Gulf and Gulf of Oman.

The Persian Gulf benthic ghost shrimps (mud shrimps) fauna is still poorly understood. The primary study on shrimps of infraorder Axiidea are Sakai (2002; 2005) and Dworschak (2009) studies that limited to southern parts of the Persian Gulf and the Gulf of Oman, but recent studies in the northern coasts led to describe several new species and new records (Sepahvand et al., 2013, Sepahvand et al., 2015a;

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2015b; Sepahvand et al., 2018a; 2018b). In the last comprehensive study of ghost and mud shrimps, Sepahvand and Tudge (2019) by reviewing previous studies in the region, recorded Six species of Gebiidea and 18 species of Axiidea containing; Upogebiidae (6 species), Axiidae (1), Callianassidae (5), Callianideidae (1), Callichiridae (9) and Ctenochelidae (2) from the Persian Gulf and the Gulf of Oman.

It must be considered, most of studies in the northern coasts are limited to coastal and intertidal regions. The comprehensive Persian Gulf explorer Cruise was carried out in the Persian Gulf and the Gulf of Oman in April-May 2019 and proper a unique collection of subtidal Axiidian shrimps.

The higher-level classification of the family Callianassidae is in a state of flux (see Manning & Felder 1991; Tudge et al. 2000; Robles et al. 2009; Sakai 2011). Recently Poore et al., 2019 released the new classification of Axiidea via morphological character states, following Robelsl et al (2020) presented a classification of the family and genera of Callianassidae and related families based on multigene analysis of two mitochondrial (16S, 12S) and two nuclear (histone 3, 18S) markers from 123 named species. It seems that unsatisfactory state of ghost shrimp systematics will be continued. Here we follow Poore et al., (2019) classification to taxonomic assign the ghost shrimps material that collected in the Persian Gulf explorer cruise.

Materials and Methods

The Persian Gulf Explorer (1901) was down in 45 stations in transects parallel to coastal line during April-May 2019 (Fig.1). Sampling was done by box corer from soft substrate in the Persian Gulf Explorer Cruise. Three subsamples were studied in each stations. All biological samples were washed over a 500 μ m sieve and sorted under a stereomicroscope. Extracted fauna was transferred to 70% ethanol and identified. Axiidean shrimps were subsequently deposited at the Iranian National Institute for Oceanography Collection (INIOC).

Results and Remarks

Taxonomic account

Infraorder Axiidea de Saint Laurent, 1979.
Superfamily Callianassoidea Dana, 1852.
Family Callianassidae Dana, 1852.
Genus *Aqaballianassa* Poore, Dworschak, Robles, Mantelatto & Felder, 2019.
Aqaballianassa ehsani (Sepahvand, Tudge and Momtazi, 2018)

Material examined: 2 male (14 mm and 12 mm), (INIOC2- 50), Gulf of Oman, Iran, Station T10S2, 25.2237454 ºN , 59.1107001ºE, 150 m deep.

Remarks:The present specimen agree well with the original description of *Aqaballianassa ehsani* from the Gulf of Oman (Sepahvand et al. 2018). Our specimen was collected at sublittoral depth of 150 m, while the type specimens were collected from intertidal zone. It is suggested that the species has a rather wide bathymetric range.

Genus *Caviallianassa* Poore, Dworschak, Robles, Mantelatto & Felder, 2019.
Caviallianassa sp.
(Figure 2)

Material examined: 1 male (12mm), (INIOC1-235), Persian Gulf, Iran, Station T10S2, 25.2237454ºN, 59.1107001ºE, 150 m deep.

Remarks: The present specimen agrees generally with *Caviallianassa cavifrons* (Komai and Fujiwara 2012), but significant differences are seen in the maxilliped 3 and major cheliped morphology. Merus of large cheliped in Caviallianassa sp. twice as long as wide; dorsal margin almost straight with two small spines proximally; ventral margin with arcuate proximal tooth (meral hook) bearing basal tooth; meral margin is straight and smooth distally whereas merus in *C.cavifrons* about 0.9 times as long as ischium; dorsal margin convex, unarmed; lateral surface ventrally forming concavity to accommodate proximoventral margin of carpus; mesial surface generally flat; ventral margin with moderately large, hook-like, sharply

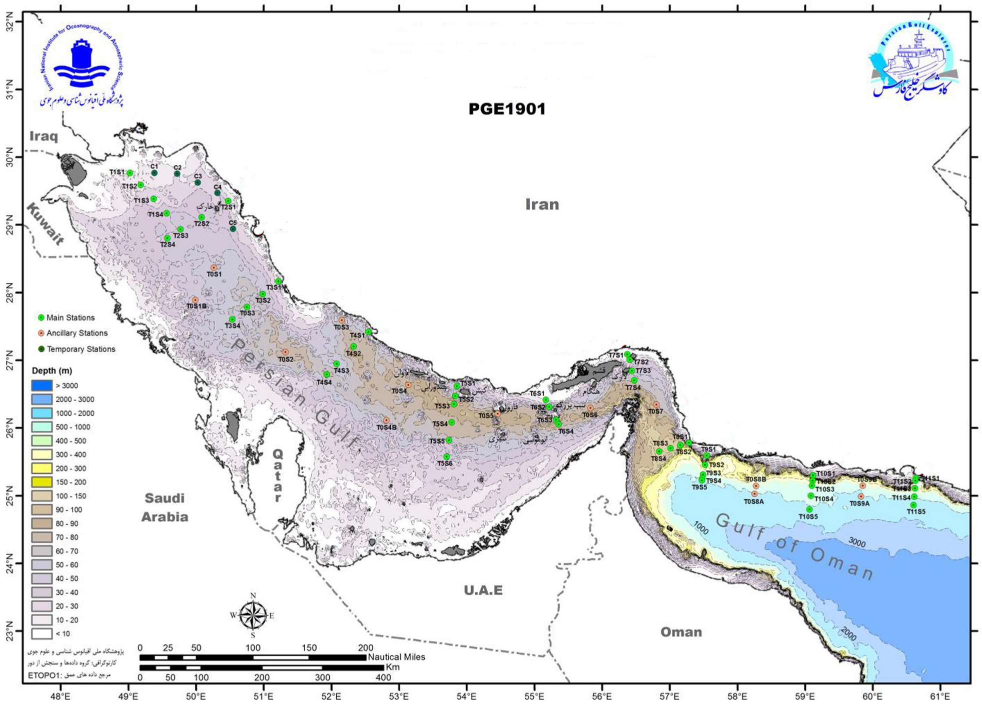

Figure 1. Map of the study area and locality of stations in the Persian Gulf Explorer cruise 1901.

pointed spine proximally and row of small tubercles distal to hook-like spine.

Maxilliped3 in *Caviallianassa* sp. has narrow ischium-merus and subrectangular ischium that 1.9 times as long as broad; crista dentata with a row of fine and slender denticles; merus subtriangular, two-thirds length of ischium, mesial margin broadly convex, distal margin entirely facing to carpus distally; carpus triangular, 1.5 times as long as broad; propodus subquadrate, longer than broad, with entirely convex ventral margin; dactylus digitiform, smaller than propodus, whereas in *C.cavifrons*, third maxilliped; ischium-merus broadly subrectangular, operculiform, 1.3 times longer than wide; ischium 1.1 times wider than long, crista dentata consisting of row of small slender spines; merus about 0.6 times as long as ischium, about 1.6 times wider than long, distolateral margin slightly produced in broadly rounded lobe, but unarmed; distomesial margin also unarmed; carpus subovate, subequal on length to merus; propodus 2.0 times longer than high and subequal in length to carpus; dactylus moderately slender, digitiform, about 0.7 times as long as propodus.

This is a first report of the genus *Caviallianassa* from the northwestern part of the Indian Ocean and also third species of this genus around the world.

Family Callichiridae Manning & Felder, 1991.

Genus *Michaelcallianassa* Sakai, 2002.

Michaelcallianassa persica Sepahvand, Momtazi and Tudge, 2020.

Material examined: 1 female (6.7 mm) and 1 male (7.8 mm), (INIOC1-222), Persian Gulf, Iran, Station T10S2 25.5747848ºN, 53.7012269ºE, 38 m deep.

Remarks: This species was described for the first time from the Persian Gulf based on specimens of the Persian Gulf explorer Crouse collection.

Family Ctenochelidae Manning & Felder,

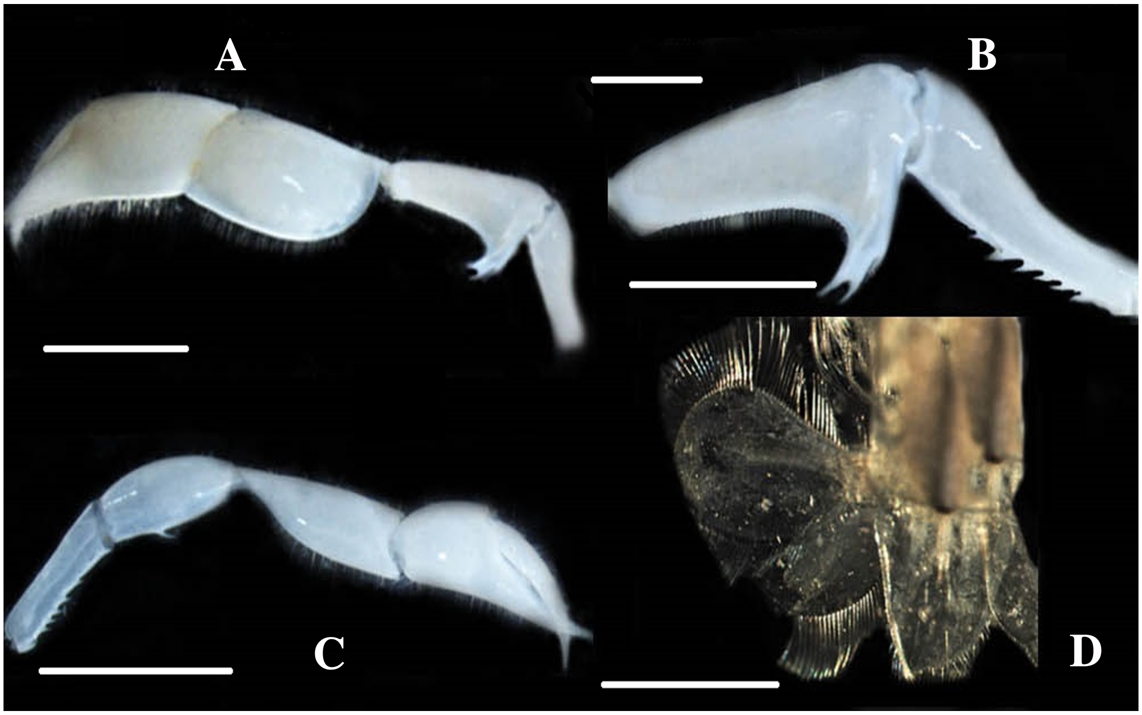

Figure 2. *Caviallianassa* sp., A: large cheliped outer view. B: ischium-merus of large cheliped, C: small cheliped outer view, D: telson dorsal view. Scale bar: 1mm.

1991.

Genus *Gourretia* de Saint Laurent, 1973.

Gourretia cf. qeshmensis Sepahvand, Rastegar-Pouyani and Momtazi, 2016.

Material examined: 1 male (15mm), (INIOC-1 226), Strait of Hormoz, Persian Gulf, Iran, Station: T7S3, 26.8461569ºN, 56.4408207ºE, 56m deep; 1 male (11 mm), (INIOC-1 227), Persian Gulf, Iran, Station: T3S3 , 27.788283ºN, 50.750817ºE, 63.5m deep.

Remarks: This species was reported by Sepahvand et al 2016, from strait of Hurmuz, Persian Gulf and the specimens in the present study agree well with Sepahvand et al., 2016 drawings except for the number of spines on the Ischium of large chelipeds.

Family Eucalliacidae Manning & Felder, 1991.

Andamancalliax sp.

(Figure 3)

Material examined: 1 male (2.2 mm), (INIOC2-51), Gulf of Oman, Iran, Station T10S2, 25.2237454 ºN, 59.1107001 ºN, 150 m deep.

Remarks: *Andamancalliax* was established by Sakai 2011 and Poore et al (2019) recognized and confirmed it. The specimens of the present study with the following character states strongly assign to the Andamancalliax genus: Maxilliped 3 ischium and merus narrow, more than twice as long as wide at their articulation; ischium with strong proximal lobe on lower margin, wider proximally than distally. Major cheliped broad, minor cheliped narrower, with long fingers. *Andamancalliax* sp. is the first member of *Andamancalliax* described from Iranian subtidal waters and can be differentiated by a large cheliped with a ventro-proximal spine on the merus. Also the specimens of the present study recorded the second species of *Andamncalliax* genus around the world.

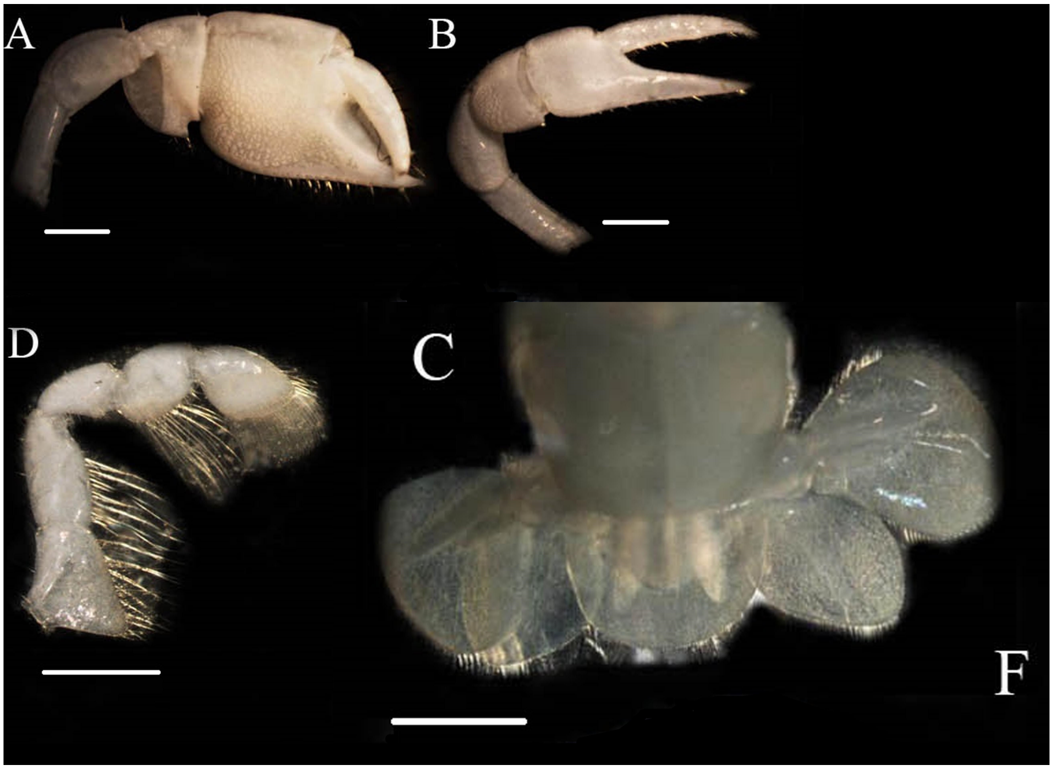

Figure 3. *Andamancalliax* sp., A-D, A: large cheliped inner view. B: small cheliped outer View. C: telson and uropod, dorsal view. D: Maxilliped 3 outer view. Scale bar: 1mm.

Discussion

The present study shows that ghost shrimps are associated with different habitat types and were found only in five out of 50 stations. Despite several attempts, no mud shrimps were found along the entire coast and continental shelf and subtidal waters of the northeast Persian Gulf (including Khuzestan and the eastern part of Bushehr Provinces) possibly due to the degraded nature of the habitat including dominance of very soft sediments, higher salinity or pollution. Several studies was revealed that the heavy metal concentrations in the northern Persian Gulf including Bushehr and Khuzestan Provinces are higher than that of other regions of the Gulf (see Diagomanolin et al., 2004; Pourang et al., 2005; Dehghan-Madiseh et al., 2009). This is mainly due to oil pollution and other anthropogenic impacts.

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Conflicts of Interest

The author declares that there is no conflicts of interest.

References

Dana, J.D. (1852). Conspectus Crustaceorum, etc. Conspectus of the Crustacea of the Exploring Expedition under Capt. Wilkes, U.S.N., including the Crustacea Cancroidea Corystoidea. Proceedings of the Academy of Natural Sciences, 6, 73–86.

Diagomanolin, V., Farhang, M., Ghazi-Khansari, M., & Jafarzadeh, N. (2004). Heavy metals (Ni, Cr, Cu) in the Karoon waterway river, Iran. Toxicology letters, 151, 63–67.

Dworschak, P.C. (2005). Global diversity in the Thalassinidea (Decapoda): An update (1998–2004). Nauplius, 13, 57–63.

Dworschak, P.C. (2009). On a small collection of thalassinidean shrimp (Crustacea: Decapoda) from Qatar (Persian–Arabian Gulf). Annalen des Naturhistorischen Museums in Wien, 110 (B), 129–137.

Hernáez, P. (2018). An update on reproduction in ghost shrimps (Decapoda: Axiidea) and mud lobsters (Decapoda: Gebiidea). Türkoğlu M., Önal U, Ismen A., Marine Ecology, IntechOpen, 231–253.

Hernáez, P., Villegas-Castro, E., João, M. C. A., Duarte, R. C., & Rivadeneira, M. M. (2021). Inferring the mating system in the burrowing shrimp *Lepidophthalmus bocourti* (Decapoda, Axiidea, Callichiridae) from the social structure and sexual dimorphism. Behavioral Ecology and Sociobiology, 75, 1–14.

Madiseh, S. D., Savary, A., Parham, H., & Sabzalizadeh, S. (2009). Determination of the level of contamination in Khuzestan coastal waters (Northern Persian Gulf) by using an ecological risk index. Environmental monitoring and assessment, 159, 521–530.

Manning, R.B., & Felder, D.L. (1991). Revision of the American Callianassidae (Crustacea: Decapoda: Thalassinidea). Proceedings of the Biological Society of Washington, 104, 764–792.

Poore, G. C. B., Dworschak, P. C., Robles, R., Mantelatto, F. L., & Felder, D. L. (2019). A new classification of Callianassidae and related families (Crustacea: Decapoda: Axiidea) derived from a molecular phylogeny with morphological support. Memoirs of Museum Victoria, 78, 73–146.

Pourang, N., Dennis, J. H., & Ghourchian, H. (2005). Distribution of heavy metals in Penaeus semisulcatus from Persian Gulf and possible role of metallothionein in their redistribution during storage. Environmental Monitoring and Assessment, 100, 71–88.

Robles, R., Dworschak, P.C., Felder, D.L., Poore, G.C.B., & Mantelatto, F.L. (2020). A molecular phylogeny of Callianassidae and related families (Crustacea: Decapoda: Axiidea) with morphological support. Invertebrate Systematics 38: in press. https://doi.org/10.1071/IS19021.

Saint Laurent, M. de. (1973). Sur la systématique et la phylogénie des Thalassinidea: définition des familles des Callianassidae et des Upogebiidae et diagnose de cinq genres nouveaux. Comptes Rendus Hebdomadaires de Séances de l'Académie des Sciences, Paris, 277, 513–516.

Sakai, K. (2002). Callianassidae (Decapoda, Thalassinidea) in the Andaman Sea, Thailand. Phuket Marine Biological Center Special Publication, 23, 461–532.

Sakai, K. (2005). Callianassoidea of the world (Decapoda, Thalassinidea). Crustaceana Monographs, 4, 1–285.

Sakai, K. (2011). Axioidea of the world and a reconsideration of the Callianassoidea (Decapoda, Thalassinidea,Callianassida). Crustaceana Monographs, 13, 1–616.

Sepahvand, V., Momtazi, F., & Tudge, C. (2015a). *Cheramus iranicus*, a new species of ghost shrimp (Decapoda: Axiidea: Callianassidae) from the Persian Gulf, Iran. Zootaxa, 4040, 215–224.

Sepahvand, V., Pouyani, N. R., & Momtazi, F. (2015b). A new species of *Gourretia* (Decapoda: Axiidea: Gourretiidae) from the Persian Gulf, Iran. Journal of the Marine Biological Association of the United Kingdom, 96, 1671–1675.

Sepahvand, V., Tudge, C., & Momtazi, F. (2018a). *Callianassa ehsani*, a new species of Callianassidae (Crustacea, Decapoda, Axiidea) from Gulf of Oman, Iran. Zootaxa, 4410, 370–378.

Sepahvand, V., Komai, T., Momtazi, F., & Shahabi, S. (2018b). A new species of the ghost shrimp genus *Neocallichirus* Sakai, 1988 from Iran, and new record of *N. manningi* Kazmi & Kazmi, 1992 (Decapoda: Axiidea: Callianassidae). Zootaxa, 4527, 239–254.

Sepahvand, V., & Tudge, C. C. (2019). Update on the burrowing shrimps (Axiidea and Gebiidea) of the Persian Gulf and Gulf of Oman, Iran including first finding of Corallianassa martensi (Miers, 1884) in Iranian waters. Journal of Animal Diversity, 1, 1–8.

Sepahvand, V., Momtazi, F., & Tudge, C. (2020). A new species of ghost shrimp of the genus *Michaelcallianassa* Sakai, 2002 (Crustacea: Decapoda: Axiidea: Callichiridae) from subtidal waters of the Persian Gulf, Iran. Zootaxa, 4810, 383–388.

Tudge, C.C., Poore, G.C.B. & Lemaitre, R. (2000). Preliminary phylogenetic analysis of generic relationships within the Callianassidae and Ctenochelidae (Decapoda: Thalassinidea: Callianassoidea). Journal of Crustacean Biology, 20, 129–149.